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SCIENCE

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CONTENTS

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MEDICAL ZOOLOGY IN EUROPE[1]

MY appointment as a representative of the school of hygiene and public health of the Johns Hopkins University to the Congress of the Royal Institute of Public Health which met in Brussels on May 20 to May 24, 1920, made it possible for me to spend over four months at institutions where medical zoology is taught and investigated in Belgium, France, England, Switzerland, Italy and Monaco. Among the institutions visited were faculties of science and medicine connected with universities and medical schools, research institutions both private and governmental, biological stations at the seashore, natural history and medical museums, veterinary schools, sanitary institutes, schools of tropical medicine, army and navy medical colleges, experiment stations, and academies of science. In all 67 such institutions were visited and over 150 men who are more or less interested in protozoology, helminthology or medical entomology were interviewed. An opportunity was thus afforded to become fairly well acquainted with the status of medical zoology in Europe.

Paris is, of course, the most active educational center in France. Here are located the faculties of science and medicine of the University of Paris, the Pasteur Institute, the National Museum of Natural History and the National Veterinary School. In the medical school courses are given in parasitology, tropical medicine, and colonial medicine and work is carried on for the Doctor of Science degree. The recent death of Blanchard has taken from France the grand old man in parasitology. His laboratory is now in charge

[1] From the department of medical zoology of the school of hygiene and public health of the Johns Hopkins University, Baltimore, Maryland, U. S. A. Read before the Society of Hygiene of the Johns Hopkins University, November 3, 1920.

of Professor E. Brumpt who has working with him Dr. M. Langeron and Dr. C. Joyeux. The laboratories are pleasant and comfortable and are excellently supplied with collections of specimens, charts, and reprints. Professor Brumpt is revising his book on parasitology and is studying piroplasmosis in dogs and cattle; Dr. Joyeux is devoting his time to the problem of the transmission of tapeworms in cattle and poultry and is carrying on experiments with mealworms and Dr. Langeron is at work on the morphology of mosquitoes. Also connected with this laboratory are Dr. Robert Dollfus who is preparing a monograph on larval trematodes and Dr. E. Tejera, of Caracas, who is investigating Chagas' disease. Here I heard the first of the complaints that I was destined to listen to throughout my entire trip. As in other countries the cost of living has increased out of all proportion to the salaries paid to men in educational work; the cost of printing has risen to such a degree that investigators are unable to publish the results of their work; and the unfavorable rate of exchange makes it practically impossible for either men or institutions to purchase scientific books and periodicals. I was asked by many of the men I visited to do all I could to help them obtain American publications, and enquiries were made as to the possibility of publishing in American journals. These countries have also suffered more than we have from the loss of young men, a condition it will take several generations to remedy.

Professor G. Caullery and his associate, Dr. C. Perez, of the faculty of sciences, occupy a building that was formerly a residence several squares from the Sorbonne. Here they have conducted important researches in protozoology and entomology.

The Pasteur Institute in Paris need not be described to this audience. It is not as badly off as some of the other institutions visited; its income is, I believe, about the same as before the war but due to the increase in prices, has a purchasing power only one third as great as formerly. Professor A. Laveran, who discovered the malaria organism in 1880 and has done such fine work with trypanosomes and other protozoa is now very old. Nevertheless, he goes to his laboratory every day including Sunday, and took an active interest in my account of the experimental work being done with trypanosomes in this school. His colleague, Professor F. Mesnil, is very energetic and an enthusiastic investigator of blood-inhabiting protozoa. Other investigators now working with Laveran and Mesnil are Dr. G. Franchini, of the University of Bologna, who is studying the relation between the intestinal flagellates of insects and the blood-inhabiting flagellates of man, and Dr. Perard, of the School of Veterinary Science of Paris, who is studying the human trypanosome, *T. venezuelense,* recently discovered in Venezuela.

An awakening to the value of public health work in France and other European countries is evident from the plans reported to me by various men in Paris. Dr. Brumpt told me of a school of hygiene and public health which is to be established in Paris as soon as funds are available; Dr. Franchini stated that the Italians hoped to build up a school of hygiene in Naples; and later I was told by Dr. O. Van der Stricht, of Ghent, that a similar institution is planned by the Belgians for Antwerp.

The National Museum of Natural History in Paris is an institution every zoologist visits with reverence since it is associated in our minds with the names of such men as Lamarck, Cuvier and Buffon. The collections include type specimens of many of our best known animals that were prepared for exhibition purposes, named and described by these early naturalists. To a medical zoologist the most interesting exhibit here is that of the Arachnida made by Dr. E. Simon. This, I believe, is the best collection in the world, and includes representatives of all species that are known to transmit piroplasmas, spirochetes, rickettsias and other pathogenic protozoa. The methods of preserving and mounting these and other specimens are very instructive.

At Alfort near Paris is the National Veterinary School. The French helminthologist,

Railliet, did most of his work here. Only recently he has retired and his former colleague, Professor A. Henry has taken his place. The investigations carried on here are naturally with the parasites of domestic animals; but comparative helminthology is a subject of great importance since it is continually illuminating many of the puzzling problems in human parasitology.

Opportunity was afforded me while in Paris to attend meetings of two scientific societies, the Biological Society and the Academy of Sciences, where many current investigations in medical zoology are reported.

Outside of Paris are many French institutions that count among their instructors men who are interested in some phase of medical zoology. Most of the universities, however, have only partially recovered from the war. At Amiens the Bureau of Hygiene occupies only two small rooms in the City Hall and is devoted principally to water analysis. The hospital is in poor condition and certain of the professors in the medical school must supplement their salaries by the income derived from drug stores. The school of medicine at Lille was stripped by the Germans of nearly everything and must be built up again almost from the beginning. The department of medical zoology under the direction of Professor P. Verdun and Dr. P. Desoil is gradually recovering and a small but good collection is being formed.

The University of Rennes was not in the war zone and is suffering only from loss of men and lack of funds. Professor L. Bordas was at work here on entomology. The universities at Toulouse and Bordeaux were closed when I visited them.

The French coast is dotted with biological stations where men from France and other countries have been accustomed to gather during the summer. The Russian Zoological Station is situated at Villefranche-sur-Mer near Nice. Here before the war there were usually about thirty investigators during the summer. Now the station is occupied by only one man, Dr. G. Tregouboff, a protozoologist.

The oceanographic museum of Monaco built and maintained by the Prince of Monaco, who has for many years been interested in oceanographic research, appears to be very little affected by the war. Here I found Drs. L. Sirvent, G. Dahl and M. Oxner at work on the various phases of oceanography, parasitic organisms being only incidentally studied.

The zoological station at Cette which normally accommodates about thirty investigators is being used by only one man, a protozoologist, Dr. J. L. Lichtenstein. The biological station at Arcachon near Bordeaux, formerly was used in the summer by sixteen or more investigators and published the results of their researches. At present it is deserted except for the director, Professor A. Jolyet.

Much better conditions were encountered at Roscoff on the northern coast of France. I found about fifty men at work here under the leadership of Professor Y. Delage. These investigators came from many cities and countries. Paris, Montpellier, Strassbourg, Bucarest, Bordeaux, Rennes, Utrecht, etc., were represented. Nevertheless the station is not so flourishing as before the war.

The Congress of the Royal Institute of Public Health which was held at Brussels on May 20 to May 24 was successful in every way. Large numbers of members and visitors attended, coming especially from France, Belgium, England and the United States. King Albert honored the congress by his presence at the inaugural meeting and Queen Elizabeth entertained the ladies of the congress at her home at Laaken. Sections were held at which papers were read and discussed on state medicine, naval, military, tropical and colonial medicine, municipal hygiene, industrial hygiene, bacteriology, chemistry, and hygiene and women's work. The Harben Lectures were delivered in English by Professor Maurice Nicolle, who spoke on antigens and anti-bodies, and the Harben Gold Medal was presented to General Gorgas at the final banquet given in the Taverne Royale on May 24. Excursions were arranged to the Belgium Front and to institutions of public health interest in the neighborhood of Brussels.

The School of Tropical Medicine in Brus-

sels exists for the purpose of training both men and women for work in the Belgian colonies. Among these are sanitary inspectors, missionaries, both Roman Catholic and Protestant, negroes for practical work in the villages and female nurses as assistants for the physicians at the larger stations. The rooms of the chateau in which the school is located have been successfully modified into laboratories and class rooms. Dr. Broden has charge and is assisted by men who are connected with neighboring institutions. Dr. Broden teaches protozoology; tropical pathology is taught by Professor C. Firket, of Liège; bacteriology and helminthology by Professor L. Jacque, of the University of Brussels, and medical entomology by Professor G. Severin, of the Museum of Natural History. Three courses of fifteen weeks each are given each year because of the great demand for trained helpers in the tropics.

No one who visits Brussels should fail to call on Dr. J. Bordet at the University of Brussels and on Drs. Severin and Ball who are engaged in entomological research at the Royal Museum of Natural History. Dr. L. Gedoelst, a prominent parasitologist, is located at the School of Veterinary Medicine here. Trips to Liège, Louvain, Bruges and Ghent may be arranged very easily from Brussels.

The parasitologists of Switzerland are scattered among the universities. At Basel is located Professor F. Zschokke who has published investigations on both protozoa and parasitic worms. Associated with him is Dr. Menzul who is a student of the nematodes. At Neuchatel, Professor O. Fuhrmann has charge of the department of zoology, and carries on researches in animal parasitology. The University of Lausanne possesses an Institute of Hygiene and Parasitology of which Professor A. Galli-Valerio has charge. This institute has beautiful laboratories and equipment and an excellent collection but at present its funds are so low that the director is without competent assistants; the result is that a large part of his time is devoted to taking care of the laboratory. At Geneva there is a similar institute with Professor E. André in charge. One of the few scientists who are not officially connected with some educational or governmental institution is Dr. E. Penard, of Geneva, who has been for many years one of the foremost students of the protozoa. Dr. Penard now has completed the manuscript of two monographs on ciliates and flagellates respectively but has no funds for their publication.

Successful visits were made to two of the universities in Italy. In Turin I found Professor E. Perroncito at the Medical Veterinary School. Dr. Perroncito was one of the first to interest himself in animal parasites. He is at present attempting to increase the food supply in Italy by popularizing bee-keeping. Professor C. Parona, another of the older parasitologists was absent, from his laboratory in Genoa. Professor B. Grassi, of Rome, is hard at work on a campaign for the eradication of malaria in the neighboring city of Fiumicino. Dr. Grassi has never lost interest in this subject since he first proved that certain mosquitoes transmit the malaria organism from man to man. Other students of animal parasites in Rome are Professor A. Splendore, who has just published an account of the parasites of the field mouse, and Professor G. Alessandrini, who is located at the zootechnical institute. As in France, Belgium and Switzerland the salaries of scientists in Italy have not kept pace with the cost of living and the funds available for carrying on and publishing investigations are woefully inadequate.

London is perhaps the greatest center of medical education and research in the world. Here are located a flourishing school of tropical medicine, army and navy medical schools, various other government institutions that support medical research, private research foundations, medical schools connected with a number of hospitals, medical museums and many medical societies. Besides this there are colleges and natural history museums where men are studying medical zoological subjects.

The London School of Tropical Medicine has recently moved into a building that was formerly used as a hotel but has been adapted for hospital and teaching purposes. The first

three floors are devoted to laboratories and class rooms and the upper four floors are used as a seaman's hospital. Here patients with tropical diseases are brought from the hospitals at the docks and both students and instructors have access to an abundance of material. The subjects in which laboratory instruction are given are protozoology, taught by Professor J. G. Thomson; helminthology, by Professor R. T. Leiper, and medical entomology, by Professor A. Alcock. Besides this there are numerous lecturers. Among those that I heard during my six week's residence at the school were Dr. Castellani, on mycology; Dr. James, on malaria; Sir Leonard Rogers, on leprosy; Sir Joseph Cantlie, on liver abscess; Dr. G. C. Low, on amebic dysentery, and Dr. P. Manson-Bahr, on bilharziasis and kala-azar. The clinical side of tropical medicine is in charge of Drs. Low and Manson-Bahr and Sir Joseph Cantlie; and the pathological side is in the hands of Professor H. B. Newham. The course occupies twelve weeks and each of the three laboratory subjects, protozoology, helminthology and medical entomology, is given a total of 72 hours. The clinical and pathological aspects of medical zoology are entirely under the control of the medical staff. The latter are particularly interested in methods of treatment and are frequent contributors to the literature on this subject. The regular instructors devote their spare time to the parasites themselves. Dr. Thomson is continuing his serological work on malaria, and Dr. Leiper is carrying on investigations on the elimination of hookworm from mines. In the same building, with the School of Tropical Medicine, is the Tropical Diseases Bureau, under the direction of Dr. A. G. Bagshawe. This bureau publishes the *Tropical Diseases Bulletin* and the *Tropical Veterinary Bulletin*.

Across the street from the School of Tropical Medicine are the new laboratories of the Wellcome Bureau of Scientific Research. No teaching is done here and so the men may devote their time to research. Dr. A. Balfour, who is director of the bureau, and Dr. Ç. M. Wenyon, are both protozoologists. Entomology is in charge of Dr. Dudgeon. The museum of the Wellcome Bureau is being transferred from another part of the city to the new laboratory buildings. In this museum Dr. Daŭkes has developed in a remarkably successful manner exhibits of infectious diseases for the purpose of visual instruction. He has divided these diseases into four groups according to the method of infection, namely, contact infections, mouth to mouth infections, excremental infections and blood infections. Photographs, drawings, transparencies, preserved specimens of vectors, models and pathological specimens are all used to create a lasting mental picture of each disease.

The men at the Lister Institute of Preventive Medicine are for the most part still engaged on problems initiated by war conditions. Dr. J. A. Arkwright showed me specimens of the supposed organism, *Rickettsia,* of Trench Fever; Dr. A. Bacot is rearing flies aseptically, has devised a method of hatching mosquito eggs within about four minutes although they have been kept in the laboratory from two to nine months, and demonstrated to me fleas containing plague bacilli; the protozoologist, Dr. H. M. Woodcock is studying some very interesting flagellates that occur in sheep and goat dung and that exhibit what appear to be sexual phenomena. Sir David and Lady Bruce had both for many years before the war been investigating trypanosomes and have extensive collections of slides and colored drawings.

At the Royal Army Medical College are the various types of laboratories to be expected in such an institution. Colonel J. A. Anderson exhibited to me a collection of models illustrating especially methods of dealing with soil pollution and mosquito control in the army. Colonel S. L. Cummins and Major Perry are both pathologists who are interested in parasitic protozoa and worms.

The subject of tropical medicine at the Royal Naval Medical College at Greenwich is in charge of Rear-Admiral Bassett-Smith, who has as his assistant Major E. L. Atkinson. Both of these men have been active in investigations of diseases due to protozoa and para-

sitic worms. Their laboratories are comfortable and well equipped.

One of the most interesting government institutions in London is the National Institute for Medical Research. Here are gathered together a number of men who devote their entire time to investigation. Among the members of the staff are Dr. C. Dobell, the protozoologist who has recently published a book on the Amoebæ Living in Man. Working with Dr. Dobell was Dr. M. Koidzumi, of Formosa, who is studying the intestinal protozoa of termites.

Another institution devoted to research is the Rothampsted Experiment Station at Harpenden near London. The subjects dealt with here include protozoology, entomology and mycology. Dr. D. W. Cutler, who seems to have been the first to successfully cultivate the amoeba of dysentery in artificial media, is now studying the protozoa of the soil in relation to soil bacteria. Dr. A. D. Imms is investigating the sensitiveness of insects to various chemicals. He finds that insects of interest to medicine are much more easily attracted by odoriferous substances than those of agricultural importance.

Several members of the staff of the Natural History Museum at South Kensington are studying animal parasites or their vectors. Dr. H. A. Baylis is building up the department of helminthology; Dr. E. E. Austen is continuing his work on tsetse flies and Dr. G. C. Robson is studying the anatomy of snails that serve as intermediate hosts of the trematodes of schistosomiasis.

Lack of time forces me to list with only slight comment other institutions and investigators who are interested in medical zoology that I was able to visit in London. These included the protozoologist, Dr. Doris Mackinnon, of King's College; Professor W. M. Bayliss, the physiologist of University College; Professor A. E. Boycott, of the University College Medical School, who has carried on researches in helminthology in Cornwall; Professor W. Bullock, the pathologist at the London Hospital Medical College; Sir Frederick Andrewes, the pathologist at St. Bartholomew's Hospital Medical School; Dr. Arthur Keith, at the Royal College of Surgeons; Dr. Broughton-Alcock and Sir Ronald Ross, at the Ministry of Pensions; Professor W. J. R. Simpson, Colonel Clayton Lane and Colonel Stewart, at the Royal Society of Tropical Medicine; Dr. G. A. K. Marshall, of the Imperial Bureau of Entomology; Dr. Thomson, at the Wellcome Historical Medical Museum; Professor R. T. Hewlett, at the Medical Research Club; Professor F. E. Beddard, at the Zoological Society of London, and many others at meetings of societies already mentioned and at the Royal Society of London and the Royal Society of Medicine. Models of sanitary apparatus and exhibits of life histories of mosquitoes, flies and other animals are on display at the Royal Sanitary Institute.

The Liverpool School of Tropical Medicine was founded in 1898. Here a large amount of investigation has been carried on in the field of medical zoology. The publications of the school include 21 memoirs, many of which embody the results of campaigns carried on in various British colonies; 13 volumes of the *Annals of Tropical Medicine and Parasitology* and several text-books on malaria. The school has just become settled in its new building which was completed in 1914 but was taken over immediately for use as a hospital during the war. The laboratories, library and museum are well designed and equipped and in the hospital nearby is a ward for tropical diseases connected with a student laboratory for clinical and pathological study. The courses in protozoology, helminthology and medical entomology extend over a period of 13 weeks. The professors who have charge of the laboratory courses also instruct the students in the clinical and pathological aspects of parasitic diseases; the school differs in this respect from the London School of Tropical Medicine. At the time of my visit Professor J. W. W. Stephens was director and taught protozoology, with the assistance of Dr. Blacklock; Professor Newsted, Mr. H. F. Carter and Miss Evans were the entomologists, and Pro-

fessor Yorke and Mr. Southwell had charge of helminthology.

Four days were spent at the meeting of the British Medical Association which was held in Cambridge on June 29 to July 2. This was a well conducted and well attended meeting and the members were enthusiastic about their work and very much in earnest. The parasitological section was in charge of Professor G. H. F. Nuttall. Papers were read and thoroughly discussed and many interesting demonstrations were provided. Dr. Nuttall exhibited his extensive collection of specimens and illustrations of ticks and insects and a large series of photographs of men who have helped to build up the science of parasitology. He also had arranged for inspection the plans for the new institute of parasitology that is now being erected at Cambridge. Dr. Leiper demonstrated new and rare parasitic worms; Dr. Christopherson showed specimens illustrating bilharziasis; Colonel Stewart demonstrated stages in the migration of ascaris through the tissues of the body; Colonel James exhibited his travelling malaria laboratory; Dr. Gaskell showed pathological specimens of malaria, and Sir Leonard Rogers demonstrated with drawings some recent remarkable cures of leprosy. Working on medical zoology at Cambridge are Professor Nuttall, Professor A. E. Shipley, Professor J. F. Gaskell, Professor Graham-Smith, and Dr. Keilin. Many of the men I had met in London, Liverpool and on the continent attended this meeting and were present at the various luncheons, receptions and dinners tendered to the members and foreign guests.

Four days were also spent at the meeting of the British Association for the Advancement of Science at Cardiff. The zoological section was well attended, but very few young men were in the audience, the supply either having been wiped out during the war or directed into other lines of work. The usual sectional meetings and social events made up the daily programs. Opportunity was afforded to become acquainted with many British scientists whose names are well known to all zoologists.

My last week before sailing back to America was spent at the Marine Biological Laboratory at Plymouth, England. Here is situated a well equipped laboratory devoted almost entirely to problems in marine biology. Work on microorganisms is being carried on by the director, Dr. E. J. Allen. Among the members of the staff is Dr. Lebour, who has published investigations on helminthology.

One can not take such a trip as that briefly outlined above without being impressed by the importance of medical zoology, both as a subject for pure scientific research and as a necessary foundation for work in medicine and public health. Countries like England, France, Belgium and Italy that are situated or have colonies in tropical and subtropical regions find it necessary to investigate the relations of parasitic animals to man because of the prevalence of these organisms in the warmer countries. The war, however, in spite of the stimulus it has given certain phases of medical zoology, has so depleted the supply of young men and so reduced the funds available for scientific work that many years will be required for these countries to regain their former productivity. The result seems inevitable that the United States must assume the leadership in this as well as in other branches of science.

R. W. Hegner

The Johns Hopkins University

THE PROBLEM OF THE INTRODUCTORY COURSE IN BOTANY

Two years ago a committee of the Division of Biology and Agriculture, National Research Council, sent to a number of botanists in the United States and Canada requests for outlines of what they would plan as the best type of introductory course in botany. There was at that time a particular reason for the enquiry because of the problems introduced by the curriculum of the Student Army Training Corps.

The response was generous and the committee soon had in its possession some forty replies. These presented such divergence of opinion as to material and method in relation

to the various conditions under which botany is taught that it seemed desirable to publish a few representative outlines and some of those showing the more radical departures from the better known types of courses. A number of outlines of high school courses in botany were also included in the series of twenty which was published during 1919–20 in five numbers of *School Science and Mathematics*.[1]

An examination of the outlines soon made clear, as was to be expected, that there is great divergence of opinion on what should be the content of an introductory course and the order of presentation of its material. Yet this situation is far from indicating chaos in the methods of teaching. It means that for the most part conditions under which courses are framed are so various in schools and colleges that there can be no standardization of the introductory course. Also the personality of the instructor as shown in the technique of his teaching is a variable factor that can never be brought within bounds. There are some teachers exhibiting a spirit for experimentation and an originality of treatment that makes their outlines of refreshing interest.

Very evident is the expressed desire to make a large part of the course a study of the life activities of plants. Morphology is generally presented that knowledge of structure may make possible a study of function. The work of the plant becomes a subject of importance and the plant as a mechanism a matter of particular interest. Few of the outlines gave special emphasis to the study of types with the end in view of developing a detailed evolutionary history. The few representatives of the lower plants are obviously selected because they are organisms of importance for what they do or because of peculiarities favorable for an understanding of cell structure or reproductive processes.

There seems to be no disposition to drop out of the introductory course drill on the life histories of higher plants to establish the significance of sporophyte and gametophyte. Except in the shortest of the outlines, alternation of generations beginning with the bryophytes has a prominent place in the course. There is significance in this desire to hold students to a critical understanding of the homologies between spermatophytes, pteridophytes and bryophytes for the problems are of the sort that call for close thinking. Also, the conclusions are perhaps the most important deductions of plant morphology.

While there is an evident desire on the part of instructors to include physiological studies the practical difficulties are admittedly great. In the large introductory courses of some universities, where classes number 200 or more, physiological work must be taught largely by demonstrations unless there is an expensive equipment and a staff of numerous and capable assistants. Outlines number 2, 5 and 11 of the published series present courses organized primarily from the physiological standpoint and are of particular interest in this connection. Most instructors open the introductory course by the way of morphology, which has the obvious advantage of presenting material upon which the student may quickly be put to work, and introduce physiology with morphology as a background.

The problems of field work are an evident source of irritation. The fact seems to be that relatively few students show much interest in names or in the natural history of plants, but they frequently are attracted to a study of structure, to the physics and chemistry of plant life, and to the discussion of fundamental biological principles. Of course the teacher of a small group in a country environment can do much more with ecology than the city teacher limited to parks and gardens, and burdened with large classes. Much may be said for optional field trips attracting only the students with a keen desire to know plants and plant associations, students in whose company on a walk an instructor will find pleasure.

[1] A limited number of reprints of these outlines are available for distribution and will be sent on application to those interested in the problem of the introductory course in botany.

The study of the outlines submitted has impressed the writer with the value of direct and printed discussion of the problems of the introductory course. The problems are perhaps best understood by the interchange of experience through the publication of outlines with the reasons for their preference. Progress will come through experimentation in methods, material and texts, experimentation that can never end since each year brings new teachers to the problems.

BRADLEY MOORE DAVIS
UNIVERSITY OF MICHIGAN,

PRESENT STATUS OF THE AFFAIRS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE[1]

IT seems highly desirable that members of the association should be kept currently informed regarding the progress made in the work of the permanent secretary's office, so that they may have a somewhat clear conception of what the association is doing and how its various aims are being carried out. To this end, it is planned to publish in SCIENCE, from time to time, summarized reports of progress and notes on matters of general interest. The present report refers mainly to the period from April 1 to October 1, 1920.

Publications.—A booklet has been prepared, including the constitution and by-laws and other information. About 23,000 of these booklets have been sent to members and prospective members. Additional copies may be obtained from the permanent secretary's office. All members have been requested to fill in the blanks on an information card and a large number of these cards have been returned. The information asked for is partly for use in the preparation of the new membership list (which will be published in the spring of 1921) and partly for the files of the office. It has been found necessary to make a charge for the new membership list since the funds of the association do not allow of its publication otherwise. This charge is $1 to members who remitted before December 1, 1920; $1.50 to members who remit later. The price of the volume is $1.50 to those who are not members.

Statement Cards.—A new series of white cards has been devised and adopted, for presenting the annual statements to members. In all cases the reverse of the billing card bears the information blanks mentioned above and each member is asked to return the card with his remittance of dues. These cards make up the information file of members' names.

Master File.—A complete card list of members has been installed and is kept continually correct. These cards show the status of each member as to dues and as to membership in affiliated academies or divisions of the association.

Application Forms.—Application for membership is now made on a buff card bearing the information blanks, these cards being inserted in the information file as soon as the new member has been elected. No sponsers are now required for application. Election can not occur until the proper remittance has been received. A special application card (blue is used by new members of affiliated societies, who are eligible to membership in the association without payment of the regular $5 entrance fee.

Invitations to Join the Association.—The campaign for increasing the membership has necessarily been somewhat restricted during 1920, on account of much other work, especially in connection with the reorganization of the office, but it will be vigorously pushed during 1921. About 9,000 invitations have been sent to newly-elected members of affiliated societies, who make application by the blue card mentioned above. A strong campaign for new members is being carried out by the Local Committee for the Chicago meeting.

Special Offer Regarding Arrearages for 1917–19.—This offer (see SCIENCE, May 7, 1920, page 470, paragraph 3) was presented to 2,175 members who were in arrears for one or more years of this three-year period. Acceptances, with payment of 1920 dues and consequent reinstatement as in good standing,

[1] From a report of the Permanent Secretary presented to the Executive Committee at its meeting in New York, October 17, 1920.

were received from 161 members. According to the by-laws, members who were in arrears for 1917 or 1918, and who had not taken advantage of this special offer, were dropped from the membership list on October 1.

Notifications and Certificates.—The engraved certificates of life-membership, membership, and fellowship have been revised, as is also true of the notifications accompanying these and the notifications of election to office. Notification forms have been prepared and brought into use for acceptance of resignation from the association and for notice of retirement from the membership list on account of arrearages for over two years.

Divisions of the Association.—The arrangements provided for the Pacific Division and the Southwestern Division have been carried out. New members in the geographical provinces of these divisions make their first payment to the division. After the first year, dues are paid to the permanent secretary's office. The divisions receive from the permanent secretary's office, the entrance fees obtained through their efforts and also $1 a year for each member in good standing.

Affiliated Academies, Etc.—Eight state academies of science have become affiliated, being those of Illinois, Iowa, Kansas, Kentucky, Nebraska, New Orleans, Ohio and Wisconsin. The Southern Education Society is similarly affiliated. These organizations collect the dues of their national members (who are also members of the A. A. A. S.), using white statement cards supplied from the permanent secretary's office but sent out by the affiliated organizations. Such affiliated organizations remit to the permanent secretary's office $4 a year for each national member in good standing in the association.

Change of Office.—The permanent secretary's office has been moved to the third floor of the Smithsonian Institution building, the new quarters being much more satisfactory than the old ones. Mr. Sam Woodley has charge of the office, with two clerks.

Addressograph Plates.—Additions have been made to the addressograph plates, so that members' addresses printed therefrom show the year of election to membership, to fellowship and to life-membership. For example, the symbol 17 denotes that election to membership occurred in 1917; 17F19 means the same, with added information that election to fellowship occurred in 1919; L19 means that the member became a life-member in 1919.

Arrangement of Plates.—The file of addressograph plates is now segregated into geographical groups, the members' names for each state, etc., being filed together. For states with affiliated academies, names of academy members are segregated, each such state thus having two alphabets. Furthermore, each group of plates is subdivided to show (*a*) those who have paid and (*b*) those who have not paid dues for current year, and (*c*) life members.

STATUS OF MEMBERSHIP (SEPTEMBER 30, 1920)

No. of members paid-up for 1920..	9,649	
No. of life members..............	353	
Total paid-up membership.......		10,002
No. of members in arrears for 1919 and 1920....................	447	
No. of members in arrears for 1920 only	938	
No. of members who still owe $2 on account of dues for 1920..	55	
Total number of members not in good standing, but whose names are retained on membership list.		1,140
Total of names on membership list		11,442

Two hundred and one new members were elected between November 1, 1919, and October 1, 1920. Approximately 400 new members have been elected since the last-named date.

Burton E. Livingston,
Permanent Secretary

SCIENTIFIC EVENTS

STANDARDIZATION OF INDUSTRIAL LABORATORY APPARATUS

Through the efforts of certain apparatus manufacturers, there met informally at the Chemists Club, New York City, on August 2, representatives of the following companies to

discuss the advisability of drawing up standard specifications for laboratory apparatus to be used in their industrial research and works control laboratories: Barrett Company, General Chemical Company, Atmospheric Nitrogen Corporation, Grasselli Chemical Company, National Aniline & Chemical Company, New Jersey Zinc Company, Solvay Process Company, Standard Oil Company of New Jersey, and E. I. DuPont de Nemours & Company.

It developed at this meeting that material savings might be expected to develop from this work. Since most of these companies are members of the Manufacturing Chemists Association of the United States, a committee composed of these members was appointed by the Manufacturing Chemists Association to pass on the proposals of the informal committee and to recommend the adoption of the specifications resulting from the informal committee's work as standard for the members of the Manufacturing Chemists Association.

Arrangements have been made for full cooperation with the Committee on Guaranteed Reagents and Standard Apparatus of the American Chemical Society, and also with the committee on standards of the Association of Scientific Apparatus Makers of the United States of America. These specifications will be considered carefully by committees of these three societies, and it is expected that they will then be published as tentative for a period of six months in order to give time for general criticism. At the end of that time the specifications will be adopted as final.

In carrying on this work an effort will be made to obtain specifications which will insure the cheapest mode of manufacture of a given instrument consistent with the duties that it must perform.

To date, three meetings of this committee have been held and considerable progress has been made. The committee desires to cooperate fully with all industries, and any communications should be forwarded to the chairman, Dr. E. C. Lathrop, E. I. duPont de Nemours & Company, Wilmington, Delaware.

NEEDS OF THE GEOLOGICAL SURVEY PROGRAM

One of the features of the forty-first Annual Report of the Director of the United States Geological Survey, just made public, is the statement that though, during the 40 years of its existence, the Geological Survey's policy has been to contribute material for a national plan to gain scientific knowledge of the nation's mineral resources, yet the greatest need of the Geological Survey to-day is a plan for itself—a program. The recognized function of a scientific bureau is to collect and arrange facts upon which the nation may base its plans for future development, but the Geological Survey now finds itself unable to plan adequately its own development. It lacks that assurance of continued appropriations that would encourage or warrant long-term investigations, a few of which are absolutely essential to any forward-looking program of scientific research. The increasing gap between the government scale of professional salaries and the scale prevailing in commercial employment causes a continual change in personnel that makes the administration of scientific work almost hopeless. The responsible official, in arranging to have the work done that is most needed, actually has his choice of projects determined for him by the personnel available. For each scientist of fully tested ability the choice has to be made between several pieces of work, all of which deserve immediate attention. Even less satisfactory is the situation in which an urgent call for a geologic field examination has to be met by assigning to it an untried worker. The report holds that the net result is that the Geological Survey is not fully occupying the field which is recognized as peculiarly its own. It could, however, occupy that field. With slightly increased appropriations, and especially with the declaration of intent by Congress to regard the scientific bureau as having successfully passed its probationary period, greater stability might be expected and some progress might be made in the adoption of a program fitted to the country's needs.

THE AMERICAN JOURNAL OF HYGIENE

This journal published by the Johns Hopkins Press and supported by the DeLamar Fund of the Johns Hopkins University will be devoted to the publication of papers representing the results of original investigations in the domain of hygiene, using the term in the broadest sense to cover all applications of the mathematical, physical, chemical, medical and biological sciences to the problems of personal and public hygiene. At least six numbers, corresponding to a volume of about 600 pages, will be issued annually, beginning with January, 1921. Investigations of unusual length will be published in a series of supplementary monographs.

Dr. William H. Welch is the editor with Dr. Charles E. Simon as managing editor. They will have the assistance of the following:

Herman M. Biggs, Health Department, State of New York.
Carroll G. Bull, school of hygiene, Johns Hopkins University.
William W. Cort, school of hygiene, Johns Hopkins University.
William W. Ford, school of hygiene, Johns Hopkins University.
Simon Flexner, Rockefeller Institute, New York.
Wade Hampton Frost, school of hygiene, Johns Hopkins University.
Frederick P. Gay, University of California.
Robert W. Hegner, school of hygiene, Johns Hopkins University.
William H. Howell, school of hygiene, Johns Hopkins University.
Edwin O. Jordan, University of Chicago.
Charles A. Kofoid, University of California.
Graham Lusk, Cornell University Medical School.
Elmer V. McCollum, school of hygiene, Johns Hopkins University.
William H. Park, Health Department, New York City.
George W. McCoy, hygienic laboratory, U. S. Public Health Service.
Raymond Pearl, school of hygiene, Johns Hopkins University.
Milton J. Rosenau, Harvard University Medical School.
Frederick F. Russell, International Health Board.
Theobald Smith, Rockefeller Institute, Princeton.
Edward R. Stitt, U. S. Naval Medical School.
Victor C. Vaughan, University of Michigan.
Charles-Edward A. Winslow, Yale University.
Hans Zinsser, College of Physicians and Surgeons, New York.

THE YALE FOREST SCHOOL

On December 21 and 22 the alumni and former students of the Yale Forest School will celebrate the 20th anniversary of its founding. In September, 1900, this school first opened its doors for the training of professional foresters. The school was founded by Gifford Pinchot, forester in the Department of Agriculture, to provide trained foresters for employment in the U. S. Forest Service, with the ultimate purpose of administering these National Forest lands. At that time and for five years thereafter these forests were in the hands of the General Land Office of the Interior Department, but in 1905 they were transferred to the Department of Agriculture, and the personnel of the Forest Service, recruited partly from the men trained at Yale, took hold. On Mr. Pinchot's retirement in 1910, he was succeeded by Henry S. Graves, under whom the Yale School has been built up. When Mr. Graves resigned in 1919, his successor was W. B. Greeley, one of the earlier graduates of the Yale School.

Of 513 men who have received professional training at the Yale School, 97 are still employed by the Forest Service. Of these, 12 are engaged in research, and 85 in administration. Thirty-eight, nearly half, of these men are now in the office at Washington or in the seven district offices into which the National Forest administration is divided, and have direct charge of the general policies of the service in those districts. Twenty-six are supervisors, each in charge of a National Forest whose area averages over a million acres. One of these supervisors, in Alaska, controls twenty million acres.

There are now twelve forest schools which give more or less adequate professional training in forestry by devoting four to five years of schooling to this subject, and through a faculty sufficiently large to permit of subdivision of teaching and thus provide ade-

quate instruction. Of these twelve schools, ten are under the direction of Yale men, and eleven have Yale graduates in their faculties. In addition, forestry is taught as a subject at four other institutions by Yale graduates. In all, forty-one men from this institution are engaged in training professional foresters in America.

POSTBELLUM REORGANIZATION OF THE INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

THE results of the balloting in the reorganization of the International Commission on Zoological Nomenclature have been announced as follows:

Class of 1922 (elected in 1913):
Dr. J. A. Allen, New York, N. Y.
Dr. J. A. Bather, London, England.
M. Ph. Dautzenberg, Paris, France.
Dr. W. E. Hoyle, Cardiff, Wales.
Dr. K. Jordan, Tring, Eng.
Professor H. Kolbe, Berlin, Germany.

Class of 1925 (newly elected, vice Class of 1916):
Dr. D. S. Jordan, Palo Alto, Calif.
Professor A. Handlirsch, Vienna, Austria.
Professor R. Monticelli, Naples, Italy.
Dr. E. Simon, Paris, France.
Dr. H. Skinner, Philadelphia, Pa.
Dr. L. Stejneger, Washington, D. C.

Class of 1928 (newly elected, vice Class of 1919):
Professor C. Apstein, Berlin, Germany.
Dr. E. J. O. Hartert, Tring, England.
Dr. Geza Horvath, Budapest, Hungary.
Professor Louis Roule, Paris, France.
Dr. C. W. Stiles, Washington, D. C.

No majority was obtained for the vacancies caused by the death of Commissioner Blanchard and by the resignation of Commissioner Roule, accordingly a new vote is being taken. Each class consists of six commissioners, elected to serve nine years and selected from the zoological profession of the world at large.

SCIENTIFIC NOTES AND NEWS

THE address of the retiring president of the American Association for the Advancement of Science, to be given at the opening general session at Chicago, on the evening of December 27, by Dr. Simon Flexner, director of the laboratories of the Rockefeller Institute for Medical Research, will be on "Twenty-Five Years of Bacteriology—A Fragment of Medical Research." There will be two other general sessions at the Chicago meeting planned to be of interest not only to all scientific workers and all members of the association, but also to the general public. One of these will be to an illustrated lecture on "Mount Katmai and the Valley of Ten Thousand Smokes," dealing with the volcanic region of Mount Katmai, Alaska, by Dr. Robert F. Griggs, of the Katmai Expeditions, National Geographic Society. The other will be an illustrated lecture on "High-Power Fluorescence and Phosphorescence," by Professor Robert W. Wood, of the physics department of the Johns Hopkins University.

THE freedom of the city of Edinburgh, where he was born in 1847, was conferred upon Dr. A. Graham Bell on November 30.

THE authorities of Guayaquil have ordered that a tablet be placed in the bacteriologic laboratory of the Public Health Department of Guayaquil to commemorate the discovery of the causative organism of yellow fever. The inscription reads as follows: "In this laboratory of the Public Health Service, the prominent Japanese bacteriologist, Hideyo Noguchi, member of the Rockefeller Institute, discovered the yellow fever organism, July 24, 1919."

AT the annual meeting of the American Ornithological Union held recently in Washington, Dr. Witmer Stone of the Philadelphia Academy of Natural Sciences was elected president.

HONORARY membership in the Cooper Ornithological Club has been conferred upon Florence Merriam Bailey (Mrs. Vernon Bailey). The present honorary members roll of the club contains seven names: Robert Ridgway, elected in 1905; Henry W. Henshaw, 1919; C. Hart Merriam, 1909; J. A. Allen 1910; Frank Stephens, 1912; Edward W. Nelson, 1917; and Florence Merriam Bailey, 1920. Each of these ornithologists

has been identified with the development of the ornithology of western North America.

Dr. R. W. Hegner, of the department of medical zoology, School of Hygiene and Public Health, Johns Hopkins University, has been elected a Fellow of the Royal Institute of Public Health of Great Britain.

The Röntgen Society, London, has made the first award of the Mackenzie Davidson medal to Dr. F. W. Aston, for his paper on "Positive rays."

The C. M. Warren Committee, of the American Academy of Arts and Sciences, has voted to make the following grants: To Professor Harold Hibbert, of Yale University, the sum of $250 to aid him in the study of the constitution of cellulose and the mechanism of the reduction of unsaturated aldehydes. To Professor James B. Conant, of Harvard University, the sum of $222.25 to aid him in the study of reversible oxidation-reduction process in organic chemistry by physical chemical means.

Professor C. J. Tilden, of the department of engineering mechanics at Yale University, has accepted the directorship of a national movement which has for its immediate object the laying of a broad educational program for highway engineering and highway transportation, the details of which are soon to be announced.

L. Salazar Salinas, director of the Geological Survey of Mexico, has been in the United States to study the methods and organization of the U. S. Geological Survey.

Mr. Hubert M. Freeman, associate physicist of the radio section, Bureau of Standards, has resigned to accept a position with the Westinghouse Electric and Manufacturing Company.

Douglas R. Semmes, professor of geology at the University of Alabama, has resigned, to become assistant chief geologist of the Mexican Petroleum Co., at Tampico.

The Washington Academy of Sciences and the Botanical Society of Washington held a joint meeting on December 16, when H. M. Hall, of the Carnegie Institution of Washington, delivered an address on "Hay fever in its specific botanical relationships."

Professor Florian Cajori, professor of the history of mathematics at the University of California, addressed the Sigma Xi at Northwestern University on December 13, on "Switzerland, the mother of American geodesy."

Frank Milburn Howlett, of the Pusa Research Institute, and pathological entomologist to the government of India, has died at the age of forty-three years.

The General Interest Session of the Section of Physics of the American Association for the Advancement of Science will be on the afternoon of December 29, when the vice-presidential address on "From Oersted to Einstein," will be given by Professor Max Mason, University of Wisconsin. This will be followed by a symposium on "Recent progress in magnetism," as follows: The electron theory of magnetism, Dr. S. J. Barnett, department of terrestrial magnetism of the Carnegie Institution. Magnetic susceptibilities, Professor S. R. Williams, Oberlin College. The ring electron, Professor A. H. Compton, Washington University.

The first annual meeting of the American Meteorological Society will be held in Chicago beginning on December 29. The morning session will be devoted largely to papers on aerological work and the applications of meteorology to aeronautics. The afternoon session of the same day will include papers on various aspects of weather forecasting. The address of the president, Professor Robert DeC. Ward, will come at 2 p.m. on the 29th: "Climate and health, with special reference to the United States." This will be followed by an hour of discussion on physiological aspects of meteorology. The session will be closed with a number of short papers on instruments and observations. The sessions will be held in Rosenwald Hall, University of Chicago. There will be an inspection of the unusually complete meteorological station of the U. S. Weather Bureau, in Rosenwald Hall. Most

of the meteorological and climatological papers of the program of the Association of American Geographers will be presented on the 30th.

THE fifth annual meeting of the Optical Society of America will be held in Chicago, at the University of Chicago on Monday, Tuesday and Wednesday, December 27, 28 and 29, 1920. The program contains 32 titles, including the presentation and discussion of the reports of the committees on nomenclature and standards, of which P. G. Nutting is the general chairman. The reports are: (1) Colorimetry: L. T. Troland. (2) Lenses and Optical Instruments: J. P. C. Southall. (3) Optical Glasses: George W. Morey. (4) Photographic Materials: W. F. Meggers. (5) Photometry and Illumination: E. C. Crittenden. (6) Polarimetry: F. E. Wright. (7) Projection: L. A. Jones. (8) Pyrometry: W. E. Forsythe. (9) Reflectometry: A. H. Taylor. (10) Refractometry: C. A. Skinner. (11) Spectacle Lenses: E. D. Tillyer. (12) Spectrophotometry: A. H. Pfund. (13) Spectroradiometry: W. W. Coblentz. (14) Visual Sensitometry: Prentice Reeves. (15) Wave Lengths: W. F. Meggers.

THE Federation of American Societies for Experimental Biology meets at the University of Chicago on December 28, 29 and 30. The members of the Executive Committee for 1920 are as follows: Warren P. Lombard, president, American Physiological Society; Chas. W. Greene, secretary, American Physiological Society; Stanley R. Benedict, president, American Biochemical Society; Victor C. Myers, secretary, American Biochemical Society; A. S. Loevenhart, president, American Pharmacological Society; E. D. Brown, secretary, American Pharmacological Society; Wm. H. Park, president, American Pathological Society; Howard T. Karsner, secretary, American Pathological Society; Wm. H. Park, chairman, 315 W. 76th Street, New York, N. Y.; Howard T. Karsner, secretary, Lakeside Hospital, Cleveland, Ohio.

THE American Anthropological Association will hold its annual meeting at the University of Pennsylvania on December 27 and 28. This meeting was originally scheduled for Chicago in conjunction with the American Association for the Advancement of Science but decided to change to Philadelphia.

THE National Geographic Society announces the foundation of a series of Memoirs for the publication of the results of its expeditions. The new series will include both narratives, giving accounts of the activities of the expeditions, of interest to the general reader, and technical papers intended for specialists in the fields of science covered by the expeditions. The first number of the new Memoirs will be devoted to a general account of the Katmai Expeditions which resulted in the discovery of the Valley of Ten Thousand Smokes and the creation of the Katmai National Monument which embraces more than a million acres. This will be followed promptly by technical papers embodying the botanical, entomological, geological, and chemical results obtained by the Katmai expeditions. In order to complete the papers as rapidly as practicable the society has requested Dr. Robert F. Griggs to devote his full time to the completion of the work. He has, accordingly, resigned his position at the Ohio State University and will take up his residence at Washington on February 1.

THE *Experiment Station Record* reports that the various technical and cooperative organizations concerned with Danish agriculture have recently organized a Central Agricultural Council, known as the Landbrugsraadet, to promote their general interests. In addition to duties of a purely economic nature, this new institution also intends to disseminate information about foreign agriculture, especially that of a statistical nature, partly by furnishing prominent farmers directly with this data and partly through instructive articles in Danish agricultural periodicals.

IT is announced in *Nature* that the government of the Czecho-Slovak Republic has established, under the Ministry of Education, a Weather Bureau in Prague, to do for that country the work formerly done at the mete-

orological central stations of Vienna and Budapest. The new bureau will extend the meteorological service formerly conducted in connection with the K. k. Sternwarte, Prag-Klementinum (Astronomical Observatory). The director, Dr. Rudolf Schneider, is anxious to receive for the library of the bureau all the reports of observations and meteorological publications formerly sent to the Sternwarte, and he will be glad to send to other meteorological stations and offices publications of his bureau in exchange.

The British Secretary of State for the Colonies has appointed a committee to consider and report what steps can be taken to secure the assistance of the universities in carrying out the research work which is essential to the protection of the inhabitants of the Colonies and Protectorates from disease and to the successful development of their veterinary, agricultural and mineral resources. The members of the committee are: The Right Hon. Lord Chalmers (chairman), Sir H. Birchenough, Sir J. Rose Bradford, Sir W. Fletcher, Professor E. B. Poulton, Sir D. Prain, Sir H. Read, Sir S. Stockman, and Sir A. Strahan.

We learn from *Nature* that an Institute of Physics has now been incorporated in England and has begun to carry out its work. The object of the institute is to secure the recognition of the professional status of the physicist and to coordinate the work of all the societies interested in physical science or its applications. Five societies have already participated in this co-ordination, namely, the Physical Society of London, the Optical Society, the Faraday Society, the Royal Microscopical Society, and the Röntgen Society. The first president is Sir Richard Glazebrook, who will preside at the opening statutory meeting of the institute, which will be held early in the new year. The list of members now includes the names of more than two hundred fellows. Sir J. J. Thomson, the retiring president of the Royal Society, has accepted the invitation of the board to become the first, and at present the only, honorary fellow. The diploma of the institute is now being required from applicants for government and other positions requiring a knowledge of physics.

Dr. Robert Knox, in his presidential address before the Röntgen Society, London, on November 18, discussed the radiologist's need for fresh apparatus. According to the abstract in the *British Medical Journal* he deplored the lack of unanimity regarding the development of instrument design, which made standardization impossible. Nevertheless, a recognition of certain special needs was emerging—the need for increasingly powerful apparatus, for X-ray tubes capable of steady output, and for a method of exactly measuring radiation. He called upon the designers of high tension apparatus to set to work to produce more powerful apparatus. It seemed likely that radio-therapeutic work would be impeded in its advance unless a more penetrating radiation were available; at all events, if such high penetration were not required for treatment, this could only be proved after extensive experimental work for which the apparatus was lacking. At the suggestion of the British Scientific Instruments Research Association a meeting of medical men, physicists, and manufacturers had been called, and this resulted in the formation of a small committee empowered to draw up a list of questions about the design of apparatus required for radiographic and therapeutic work, and those questions were now being circulated among the radiologists of the country. Dr. Knox maintained that the development of radiological apparatus and technique called for cooperative experiment by physicists, technicians, and medical men. These problems could only be handled comprehensively in a radiological research institute with a suite of laboratories, lecture theaters and demonstration rooms. The establishment of such an institute was the object of the Mackenzie Davidson Memorial Fund. It would be directed by a general committee, with subcommittees for the physical, technical, medical and photographic sides of the work,

each subcommittee supervising a section of the institute, and all conferring together in cases of difficulty. An institute of physics was coming into being; why not an institute of radiology adjoining it or incorporated with it? At Petrograd a new institute of radiology had lately been inaugurated in a building of recent construction. If Bolshevik Russia, asked Dr. Knox, could erect an institute of radiology in the midst of its great upheaval, was the United Kingdom going to be outdone?

THE National Research Council has established the Research Information Service as a general clearing-house and informational bureau for scientific and industrial research. This "Service" on request supplies information concerning research problems, progress, personnel, funds, etc. Ordinarily inquiries are answered without charge. When this is impossible, because of unusual difficulty in securing information, the inquirer is notified and supplied with an estimate of cost. Much of the information assembled by this bureau is published promptly in the *Bulletin* or the "Reprint and Circular Series" of the National Research Council, but the purpose is to maintain complete up-to-date files in the general office of the council. Announcement will be made from time to time of special informational files which have been prepared. Requests for information should be addressed to the Research Information Service, 1701 Massachusetts Avenue, Washington, D. C.

THE Carnegie Foundation for the Advancement of Teaching distributed up to June 30, 1920, the sum of $7,964,000 in 664 retiring allowances and 245 pensions to widows of professors in 159 universities and colleges. This announcement has been made to the trustees, by Dr. Henry S. Pritchett, the president. The Foundations assets are $24,628,000. The Teachers Insurance and Annuity Association, established by the Foundation, during its first two years had provided for teachers in 213 institutions, 585 policies totalling $2,969,000 and 513 annuity contracts representing $540,000, or total expected payments of $6,480,000. The association's annuities have been adopted by thirty-four universities and colleges for all teachers desiring them, it was stated. President Hibben, of Princeton, President Vinson, of the University of Texas, President Perry, of Hamilton College and President Neilson, of Smith College, have been elected trustees to fill vacancies. President Humphreys, of Stevens Institute has been elected chairman; President Thwing, of Western Reserve University, vice chairman, and Chancellor Kirkland, of Vanderbilt University, secretary of the board.

WE learn from *Nature* that the English courts gave on November 17, a decision on the motion for an injunction to prevent Messrs. Brunner, Mond and Co., from distributing £100,000, as it was authorized to do by an extraordinary general meeting on August 5. It will be remembered that at this meeting the directors were empowered to distribute that sum to such universities or other scientific institutions in the United Kingdom as they might select for the furtherance of scientific education and research. The money was to be provided from the investment surplus reserve account. It was urged that in carrying out the resolution the directors would be acting a way which was outside the scope of the stated objects of the company, but Mr. Justice Eve ruled that the resolution came within the bounds of what was likely to lead to the direct advantage of the company, and therefore refused to make an order on the motion.

UNIVERSITY AND EDUCATIONAL NEWS

FRANCIS LYNDE STETSON has bequeathed his residuary estate, estimated at from $1,000,000 to $1,500,000, to Williams College, of which he was a senior trustee for many years and a benefactor during his life. He gave $100,000 additional to the college to establish eight scholarships for worthy students from Clinton County. The testator directs preference be given to students from the city of Plattsburg and the towns of Champlain, Chazy and Ausable in that order.

An anonymous donor has given Yale University bonds valued at over $100,000 for the department of university health.

Stanford University will have on its campus for the 1923 intercollegiate contests a stadium seating at least 60,000 spectators and costing approximately $750,000. The engineering commission, composed of Professors W. F. Durand, C. D. Marx, and C. B. Wing of the engineering departments of the university, has been requested to proceed at once with the preparation of the final plans of construction.

Samuel W. Dudley, at present chief engineer of the Westinghouse Airbrake Company, has been appointed professor of mechanical engineering on the Strathcona Foundation at Yale University.

Dr. Edwards A. Park, associate professor of pediatrics at the Johns Hopkins University, has been elected professor of pediatrics in the Yale Medical School. Dr. Park graduated from Yale with the degree of Bachelor of Arts in 1900.

Francis Marsh Baldwin, (Ph. D. (Illinois), associate professor of physiology in the department of zoology at Iowa State College, has been raised to the rank of professor. F. A. Fenton, Ph.D. (Ohio State), has been advanced to the rank of associate professor of entomology, and is acting chief of the Entomological Section of the Experiment Station, during the absence of Professor E. D. Ball, now assistant secretary of agriculture.

DISCUSSION AND CORRESPONDENCE

WRATTEN FILTERS

To the Editor of Science: My attention has been called to the fact that some biological workers have been using Wratten filters for measurements of the response of living animals to light, and that there is a possibility that results obtained in this way may be vitiated by the infra-red transmission of such filters. Measurements show that practically all these filters transmit the infra-red; the monochromatic series, for instance, transmit over 50 per cent. of the radiation of longer wave-length than 750 $\mu\mu$ which is transmitted by glass and gelatine. The filters were made for photographic work and are suitable for visual research, but no attempt has been made to eliminate the infra red, and they are quite unsuitable for work where infra red radiation may introduce errors unless that radiation is absorbed by some suitable filter such as the solution of copper chloride recommended by W. W. Coblentz, *Bulletin of the Bureau of Standards*, Volume VII., 1911, p. 655.

C. E. K. Mees

Research Laboratory,
Kodak Park,
Rochester, N. Y.

THE COST OF GERMAN PUBLICATIONS

To the Editor of Science: Mr. Howe's communication seems to deserve some further remarks. A recent letter from a prominent dealer in Leipzig tells me that prices for Germany are doubled for foreign customers and that he has no reason to believe that American dealers will be able to furnish at a lower rate. Postage is ten times higher and there is a government expert tax of 8 per cent. of the invoice. The course I took was to write the dealer not to send me anything; that in future I would not buy anything as an individual in Germany and would try to do the necessary reading through libraries, thereby dividing the cost among a number. I added that I objected particularly to the export tax.

George Dock

School of Medicine,
Washington University

A QUESTION OF BIBLIOGRAPHY

To the Editor of Science: In his well-known volume on "Fur-bearing Animals,"[1] the author, Elliott Coues, described on the authority of "Mr. Lockhart," an extraordinary act of the wolverene in the presence of man. The wolverene will squat on his haunches and shade his eyes with one of his

[1] U. S. Geol. Surv. Misc. Publ. VIII., Washington, 1877.

forepaws whilst peering at the intruder. In E. T. Seton's "Life-histories of Northern Animals," the story is repeated from Coues, but in the index the entry is credited to J. G. Lockhart. In the Encyclopædia Americana, the only J. G. Lockhart is the biographer of Sir Walter Scott.

Is it possible to get a line on this "Mr. Lockhart" who saw the wolverene on two occasions shading its eyes with a paw?

A. WILLEY

DEPARTMENT OF ZOOLOGY,
McGILL UNIVERSITY

JONATHAN EDWARDS AS A FREUDIAN

SINCE Jonathan Edwards has been brought forward as a precursor of Einstein, I wish to file a claim in his behalf as a pre-Freud Freudian. In that very remarkable record of autoanalysis, his Diary, he notes under date of May 2, 1722:

> I think it a very good way to examine dreams every morning when I awake; what are the nature, circumstances, principles and ends of my imaginary actions and passions in them; in order to discern what are my prevailing inclinations, etc.

Not only did Edwards use dream analysis for the discovery of his secret sins, but he also employed the Freudian therapeutics of frank self-examination starting with random reverie and following the thread of association until he reached the complex that he desired to eradicate by confession and sublimation. For instance, the entry dated "Saturday August 10, about sunset," reads:

> As a help against that inward shameful hypocrisy, to confess frankly to myself all which I find in myself, either infirmity or sin; also to confess to God and open the whole case to him, when it is what concerns religion, and humbly and earnestly implore of him the help that is needed; not in the least to endeavor to smother over what is in my heart but to bring it all out to God and my conscience. By this means I may arrive at a greater knowledge of my own heart.
>
> When I find difficulty in finding a subject of religious meditation in vacancies, to pitch at random on what alights in my thoughts, and to go from that to other things which that should bring into my mind, and follow this progression as a clue, till I come to what I can mediate on with profit and attention and then to follow that.

COLUMBIA UNIVERSITY EDWIN E. SLOSSON

SCIENTIFIC BOOKS

Plant Indicators. The Relation of Plant Communities to Process and Practise. By FREDERC E. CLEMENTS. 388 pages, 92 plates. Publication 290 of the Carnegie Institution of Washington, Washington, D. C.

This is a companion volume to Dr. Clements's book on Plant Succession.[1] The aim of the present work is to show the value of the natural vegetation as indicating climatic and soil conditions, and hence, indirectly, the suitability of the areas covered for agriculture, grazing and forestry.

The earlier literature is briefly reviewed, with especial emphasis upon publications which have appeared since the plant indicator concept became definitely established (Hilgard, 1860, Chamberlin, 1877), and especially since quantitative methods began to be employed in the study of vegetation. The indicator concept is discussed on pages 28–34, stress being laid upon the superiority of the plant community to any single species. The author's point of view is illustrated by the following quotations:

> As is shown later, plants may indicate conditions, processes, or uses. The simplest of these is the first, the most practical is the last. The plant may indicate a particular soil or climate, or some limiting or controlling factor in either. This would seem to be axiomatic, but it is well known that grassland, which is typically a climatic indicator, often occupies extensive areas in forest climates. Thus, the presence of a plant, even when dominant, is only suggestive of its meaning. It is necessary to correlate it with the existing factors and, better still, to check this correlation by experimental planting, or an actual tracing of the successional development.
>
> Indicators of processes usually require a double correlation, namely, that of the plant with the controlling factor, and that of the factor with the causal process, such as erosion, disturbance, fire,

[1] Clements, F. E., "Plant Succession," Publication 242, Carnegie Institution of Washington, 1916.

etc. . . . In the case of use or practise indicators, the sequence differs in accordance with the nature of the crop. When the crop is a natural one as in grazing, the sequence is simple and direct. . . . With forage and grain crops, the sequence is more complex, partly because the species concerned are not native, but largely because the physical conditions are unnatural as well as controlled. . . .

. . . .

. . . It is necessary to recognize that every dominant can be used as an indicator of past and future as well as of present conditions. This is due, of course, to the fact that every dominant or subdominant has a definite position in succession. . . .

Bases and criteria are treated (pages 35–75) under the following main headings: The Physical Basis, The Physiological Basis, The Associational Basis, The Successional Basis, Indicator Criteria, Life-forms, Habitat-forms, Growth-forms, and Communities as Indicators.

The third chapter (pages 76–104) deals with the kinds of indicators, which are classified as Factor Indicators, Process Indicators and Practise Indicators. Among the factors considered are water, light, temperature and solutes. In this connection, the author considers lack of oxygen as the most important factor affecting plant growth in acid soils. Discussing climatic and edaphic (soil) indicators, it is stated:

The local or edaphic conditions find their expression in the seral dominants and subdominants, and the communities which they constitute. The widespread climatic conditions are reflected in the climax formation, associations, and societies.

Process indicators belong to successional rather than to climax associations and indicate the effects of disturbances of the habitat, either "natural" or brought about by the agency of man. Practise indicators show whether the land is suitable for agriculture, grazing, or forestry, and with less certainty, to what kinds of crop and methods of production it is best adapted.

A large part of the book (pages 105–236) is devoted to descriptions of the climax formations of western North America, comprising the various associations of grassland, scrubland or chaparral and forest.

Agricultural indicators are discussed on pages 237–269. Here the author develops his ideas as to the classification of the remaining public land on an indicator plant basis, stating:

. . . it should become a cardinal principle of land classification to rate as grazing or forest land all areas in which it is impossible to produce an average crop three years out of four. This would insure an adequate and permanent development of agriculture wherever possible and would warrant the introduction of scientific and economic systems of grazing, which would change it from a game of chance into an industry.

The subject of grazing indicators is treated at greater length (pages 270–335), the author pointing out that, "the simplest and most obvious indication of a plant community is that which denotes the possibility of grazing." In regard to the carrying capacity of range land, it is stated:

With respect to the plant cover alone, the carrying capacity of a grazing type is summed up in the total amount of the annual crop of forage, but the total yield must be interpreted in terms of value and utilization. Hence, it is necessary to take into account the composition of the type, the palatability and nutritive value of the dominants and subdominants, the duration and timeliness of the grazing season, and the effects of the climax cycle.

Forest indicators are discussed on pages 336–363, and the book closes with an extensive bibliography.

Field investigations extending over many years and covering practically the whole of the western United States have fitted Dr. Clements to deal with his topic in a comprehensive and illuminating manner. The philosophical point of view is predominant throughout the work, and the relation of the subject to other branches of science, as well as to practical affairs, is convincingly presented. The care used in preparing this handsome volume and its numerous excellent illustrations deserves high commendation.

Thomas H. Kearney

SPECIAL ARTICLES

LONG-TIME TEMPERATURE PREDICTION

An approximate solution is here given for the probable temperature at any desired place, *e. g.*, Phoenix, Arizona, at any hour of the day such as 10 A.M. on any desired day, *e. g.*, August 12.

It is well known that the air gets warmer as the day advances and cools off during the night, repeating this rather regularly—also that it gets warmer in the spring and cools off in the fall. The normal air temperature therefore is a periodic function of the time with a 24-hour period and an annual period.

The following equation expresses the temperature T as a function of the time of the year t and the time of the day θ.

$$T = Ma + \frac{Ra}{2} \cos t + \frac{Rd}{2} \cos \theta. \qquad (1)$$

It is empirical and assumes that the annual march of the temperature can be represented by a simple cosine function, that the daily march can also be so represented and that the daily range does not appreciably change with the season.

The constants are readily obtained from the U. S. Weather Bureau for any desired locality. The first one, Ma is simply the mean annual temperature of the place in question, the second Ra/2 is one half of the Range of the annual march, or the difference between the mean daily temperatures of the hottest and coldest days of the year and the third constant Rd/2 is one half of the range of the daily march or the difference between the maximum and minimum temperatures for the day. Rd remains approximately constant for the United States, except for the arid west. For example the equation becomes for Chicago:

$$T = 48 + 25 \cos t + 7 \cos \theta.$$

Neither of the two marches exactly follow the cosine law. The minimum temperature does not occur exactly half way between the two maximums. As an average condition for the United States it is but 9 hours from the minimum (6 A.M.) to the maximum (3 P.M.), but 15 hours from the maximum to the following minimum through the evening. This discrepancy can be almost entirely eliminated by correcting the time from the nearest maximum on the curve in the process of changing the days and hours into degrees, *i. e.*, in the winter time consider the coldest day of the year 180° (about January 15) and February 15 would be 180 + 31° rather than counting all the way from the maximum (about August 1), 7 A.M. would be 180 + 20° and 5 A.M. 180—12°, 2P.M. 360°—20°. Thus the normal temperature at Chicago February 15 at 2 P.M. would be

$$T = 48 + 25 \cos 211° + 7 \cos 340°.$$

This formula applied to the various parts of the United States for various days of the year and hours of the day gave a mean error of 2½° F. This error was due largely to the variable time of sunrise and could be corrected if one knew even approximately the time of sunrise on the day in question.

In the arid west the daily range in temperature is not constant but is a periodic function of the time, being a maximum in the summer time and a minimum in the winter time. The reason for this is that in the summer time heat is being received fast and thus the maximum temperature attained would be larger for the same time interval than in the winter when the rate of absorption of heat is slow. In this dry area the daily range is very approximately 15° in winter and 25° in summer. Assuming this range to vary as a cosine function, which it does very approximately, the equation for the arid west becomes through the addition of one more term

$$T = Ma + \frac{Ra}{2} \cos t + \frac{Rd}{2} \cos \theta + \frac{Vv}{4} \cos \theta \cos t. \qquad (2)$$

The mean difference between the actual normal hourly temperatures and those obtained through using this equation was 2.75° F.

A careful distinction should be made between the determination of the normal temperature and the determination of the actual temperature. The above formula gives normal hourly temperature and the errors are almost always less than 5° F. and the mean error only 2.5° F.

Temperatures vary quite badly from the normals. One year differs from another by about .5° F. One January differs from another by about 2° F. and one January 4 from the January 4 of another year by an average of 4° F. These departures are caused mainly by the passage of storms with their alternate warming or cooling effects. In the arid west where irrigation and dry-farming are practised (one fourth of the earth's land area is equally dry) 80 per cent. of the days are free from rain, the sky is clear most of the time and the humidity is only 50 per cent. The departures from normal are, therefore, slight. Equation No. 2 will therefore give actual temperatures aproximately for this large area.

These actual hourly temperatures differ from the normals by from 0° F. to occasionally as much as 15 or 20° F. The normal calculated from equation two differs from the actual temperatures in the arid west by 5° F. It should be remembered, however, that the same equations gave the normal temperatures correct to 2½° F.

The U. S. Weather Bureau has continuous temperature records for several hundred cities for several decades and daily maximum and minimum temperature records for several thousand more cities. The equation submitted states approximately the law of this change in temperature with the time. Its simplicity and its generality are striking.

It has practical value in such cases as the determination of early morning temperatures where heating to protect crops from frost is practised, in calculating hourly values where thermograph records have not been taken and for engineers engaged in laying concrete, in determining the normal time in the spring and fall when freezing temperatures are experienced during working hours.

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THE AMERICAN CHEMICAL SOCIETY

(*Continued*)

The dynamics of the catalase reaction: Sergius Morgulis and Victor E. Levine. Many of the recent investigations on catalase are of little value because of incorrect technique and lack of appreciation of the dynamics involved. To draw proper deductions from experimental data it is necessary to select the proper method for the preparation of the enzyme and the proper preservative, and to regulate the hydrogen ion concentration of the enzyme as well as of the substrate. The shaking must be uniform and must begin almost as soon as the substrate comes in contact with the enzyme. The determination of the rate of evolution of oxygen is of greater importance than that of the amount of oxygen yielded within a given time. A ratio between the enzyme and substrate must be established such that the amount of oxygen liberated is directly proportional to the catalase concentration. For every catalase concentration there is an optimum amount of hydrogen peroxide. Increasing the peroxide beyond this amount results in a considerable progressive showing up of the reaction. The decomposition of hydrogen peroxide is a monomolecular reaction under the conditions of a constant substrate: enzyme ratio. With a constant quantity of enzyme the relation between hydrogen peroxide and the reaction velocity becomes inverse and logarithmic as soon as the concentration of hydrogen peroxide exceeds a certain limit. With a constant quantity of substrate the relation between the catalase concentration and the reaction velocity is direct and either logarithmic or linear, depending upon the presence or absence of an excess of peroxide. With a constant ratio between catalase and hydrogen peroxide the reaction velocities tend to approximate each other. Three types of curves are obtained when the reaction velocity is plotted against time: first, of rare occurrence, a curve showing a temporary increase in the value of K followed after one or two minutes by a slow falling off; second, a curve showing a continuous falling off, which is the most common and the one obtained when the catalase is in excess of the peroxide; third, a curve represented by a straight line, as is required by the monomolecular reaction, when the hydrogen peroxide is greatly in excess of the catalase.

The action of proteins on the phenol reagent of Folin and Dennis: Victor E. Levine. The phosphotungstic-phosphomolybdic reagent of Folin and Dennis is not specific for the phenolic group. The reagent can not serve as a test for proteins yielding tyrosine or hydrolysis, for all the proteins tested including gelatine give positive reactions.

That the phenol reagent is not specific has already been pointed out by Abderhalden, who found oxyproline and tryptophane to yield positive results. R. A. Gortner has also observed a positive response by indol. On further study we have found the color reaction to be given by a very large number of inorganic and organic substances, among which may be mentioned cuprous and ferrous salts, bromides, iodides, nitrites and sulfites, amines, aldehydes and ketones, carbohydrates, especially glucose, amyl alcohol, benzyl chloride, benzoyl chloride, benzidine, hydroxylamine, phenylhydrazine, phenolphthalein, haematoxylin, naphthylamine, animal charcoal, etc. Generally speaking the reagent seems to be affected by all sorts of substances possessing more or less reducing properties. In comparison to other methods the Folin and Dennis procedure for phenol in urine gives higher results, which may be accounted for by the presence of non-phenolic compounds reacting with the color reagent.

Digestibility of some raw starches: C. F. LANGWORTHY and HARRY J. DUELL, JR. In the experiments here reported, the digestibility of raw arrowroot (*Zamia floridana*), cassava, and rice starches was determined when eaten in quantities of approximately 150 grams per day by normal men. They were eaten as a constituent of a frozen custard. Raw cassava and rice starches were completely digested and no trace of them could be found in the feces. The average of these experiments on arrowroot starch varying from 65.0 to 99.3 per cent. was made 82.2 per cent. The subjects remained in normal health during the three-day experimental period and no abnormal physiological effects were noted.

Uses in biological sciences for standardized, sterile buffer tablets, and for a single sterile buffer solution covering all P_H values: PAULINE M. AVERY, R. R. MELLON and S. F. ACREE. Studies of growth, respiration, sporification, reproduction, physiology and morphology can be made with bacteria, fungi and molds, as well as with higher plants and animals, by the use of buffer tablets containing standardized quantities of desired chemicals giving definite hydrogen ion concentrations. Such tablets or mixtures may also contain standardized quantities of desirable indicators, dyes, colloids or other materials. Sterile culture media with or without agar can be given any desired acidity or P_H value by the addition of sterile buffer tablets, with or without indicators. Such P_H value may be made the minimum, optimum or maximum for the organism in order to stimulate or to suppress its growth or some other function, and this method can be made diagnostic for mixtures of organisms. By employing a suitable combination of photometer and turbidimeter or nephelometer, the hydrogen ion and indicator changes can be investigated, along with changes in colloidal conditions in solutions or agar-like gels. Such an apparatus as that devised by Sheppard[1] can be used for measuring the rate of growth of bacteria along with hydrogen ion changes, or the rate of development of spores in fungi. Colloidal and dispersed conditions in soil extracts, plant extracts, pulp liquors, milky solutions or suspensions of all kinds, and waters of lakes and streams, can be studied accurately along these lines, together with hydrogen ion concentrations. A single sterile buffer solution covering all P_H *values* when treated with acid and alkali, has been tested thoroughly and replaces the five or six solutions used by other workers. Such a single buffer solution and the standardized buffer tablets simplify the chemical side of exact researches in biology to such an extent that the methods can be used without chemical control by the biologist and consequently save his time for use in his own research field.

On the ionization constants of glycerophosphoric acid and the use of carbohydrate phosphates as buffers and nutrients, especially in culture media: PAULINE M. AVERY, R. R. MELLON and S. F. ACREE. Glycerophosphoric acid has ionization constants about $K_1 = 2.5 \times 10^{-7}$. These values are so close to those of phosphoric acid that the latter can be replaced as a buffer to advantage for several reasons. Glycerophosphates, sucrose and mannite phosphates and others are sources of carbohydrate food as well as of phosphorous. Over 20 organisms, including tubercle bacilli, have been grown on such buffered glycerophosphate media adjusted to different P_H values. The sodium and other glycerophosphate salts can be made and kept in anhydrous form, easier to handle and weigh than sodium phosphate. The glycerophosphate titration curve is sufficiently close to that of phosphates to replace it in all work when corrected. The calcium, magnesium and other salts of glycerophosphoric acid are soluble in contrast with the insolubility of the phosphates and can be used to study the effect of such metallic ions on growths and other func-

[1] *J. Ind. Eng. Chem.*, 12, 167.

tions, and on all kinds of catalytic reactions in pure and industrial arts. In beef-broth-peptone media, for example, the glycerophosphates do not give the troublesome precipitates formed by phosphates, and can therefore be added in the form adjusted sterile tablets or solutions to warm sterile media, with or without agar; the resulting medium is buffered, adjusted, clear and sterile for immediate use. The glycerophosphates can be sterilized in solid or liquid condition without appreciable decomposition. Similar reports will soon be made on other carbohydrate phosphates.

Hydrogen electrode measurements of the acid and basic ionization constants of asparaginic acid and its value as a buffer and nutrient material in culture media: J. H. HOPFIELD, J. B. HALSTEAD, MARGUERITE A. BRENNAN and S. F. ACREE. The hydrogen ion concentrations of solutions of $M/50$ asparaginic acid vary from 10^{-16} to 10^{-12} when the asparaginic acid is treated with acid and alkali varying from two mols of the former to three mols of the latter. Between $C_H = 10^{-5}$ and 10^{-9} there is a sharp inflection in the titration curve because of the completion of the neutralization of the stronger acid and the beginning of the neutralization of the second carboxyl. From the complete titration curve and the ionization values of the salts the constants $K_{a_1} = 1.1 \times 10^{-4}$, $K_{a_2} = 1.4 \times 10^{-10}$ and $K_b = 1.2 \times 10^{-12}$ are calculated. These are in good agreement with the values of K_{a_1} and K_b obtained by conductivity, catalysis and hydrolysis methods. The value of K_{a_2} is new and is lower than the value of $K_a =$ about 10^{-9} for asparagin, as expected for an acid salt. In another article we have shown that the inflection curves of asparaginic and phosphoric or pyrophosphoric acid mutually annul each other, and make such mixtures very fine buffer materials as well as nutrients in media for bacteria and fungi.

The nitrogenous constituents of condensed milk as compared with fresh milk: A. W. HOMBERGER and B. MATHIN.

The buoying up of the equilibrium of milk salts during meat treatment: HARPER F. ZOLLER. The precipitation of calcium from solutions of milk salts, prepared in accordance with the composition and concentration occurring in the average of normal cows milk and at the reaction of normal milk, was followed quantitatively and with the hydrogen electrode during the effect of temperature. The loss of calcium was progressive with the time and intensity of heat treatment. The hydrogen ion concentration proportionately with the removing of the buffer material (phosphates) by the calcium. Doubling the quantity of citrates above normal although not changing the initial pH of the solutions greatly reduce the precipitation of the calcium phosphate and at the same time maintained a higher final pH. Lactates and malates acted likewise. This serves to aid in explaining how the lactic souring of milk may increase its stability towards heat.

Hydrogen electrode study of the curdling in casein solutions at high temperatures: HARPER F. ZOLLER. When solutions of pure Hammarsten casein in carbonate free NaOH or KOH are heated in sealed tubes to temperatures ranging from 118° C. to 135° C. a precipitation of curd takes place, the formation of which is dependent upon the hydrogen ion concentration and the duration of heating. The casein solutions contained no calcium. All of the caseinate solutions remained clear, whose initial hydrogen ion concentration is less than 3.16×10^{-7}, (pH 6.5) although the solutions had been heated to 135° C. for forty minutes. There is a regular heating period of from 0.18 to 0.54 pH corresponding respectively to solutions of initial pH of 5.78 and 8.26. The precipitated curd is soluble in acids and alkalies and resembles the curd made from sterilized milk or milk heated to high temperatures as described by the author in a previous communication. The term β casein is suggested for this product to differentiate it from the products obtained by Lacquer and Sackur from dry casein. The significance of this phenomena in connection with the coagulation in evaporated milk is discussed.

Chemistry of digitalis: H. C. HAMILTON.

CHARLES L. PARSONS,
Secretary

(To be continued)

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